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C-A OPERATIONS PROCEDURES MANUAL

ATTACHMENT

7.1.65.r Safety Issues Associated with Cold Box 6

C-A-OPM Procedures in which this Attachment is used.		
7.1.65		

Hand Processed Changes

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 Collider-Accelerator Department Chairman Date

M. Sardzinski



SAFETY ISSUES ASSOCIATED WITH COLD BOX 6 and the WET Expander Pod (No.7) OF THE RHIC 25 kW REFRIGERATOR

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This document describes the safety issues associated with working inside and around cold box 6 and the wet expander pod of the 25 kW RHIC cryogenic refrigerator. It is not meant to cover the details of every job. A job specific work permit reviewed by appropriate personnel is still required to complete any work inside or outside the cold box and turbine housing.

MECHANICAL SAFETY ISSUES

Component details:

Cold Box 6 houses Heat exchangers Hx20, Hx21, Hx22, Hx23 and Hx24. The Cold box is a compact vertical unit which is located outside of building 1005R and between Cold Box 4 and Cold Box 5, see photo 5 and fig.A. The Wet Expander (EXP 7) contains a dynamic gas bearing turbine built by the Linde corp. It is an oil free system because the bearing system is a helium gas bearing system. Also, see figure B for the location of cold box 6.

Confined Space:

In the event of a repair or an inspection of the inner piping, instrumentation or heat exchangers that are located inside the cold box, the outer vacuum jacket must be unbolted and removed. If the vacuum jacket sections are removed, exposing the inner piping and heat exchangers (see fig. C), the hazard associated with working in a confined space is reduced or eliminated. This methodology can be applied also to the turbine housing.

If work is required on the piping and heat exchangers, ***care should be taken to ensure that all potential energy sources are eliminated.***

Before any work can be done on or inside the cold boxes a pre-job briefing must be conducted. Also, if it is noted on the work permit that the work is to be performed in a confined space, then the work must adhere to the confined space regulations described in the *BNL SBMS* section under CONFINED SPACES.

Trapped Helium Volumes:

The potential exists for trapped pockets of high pressure helium inside the cold box. Prior to penetrating any process lines inside the box, contact the cryo-control room at X3837 to verify that no trapped high pressure helium volumes exist.

Pressurized Helium Sources

Cold Box 6 and the Wet Expander Cold Box are part of the RHIC cryogenic system and have the potential to see pressurized helium gas sources. The table below is a list of potential sources and the valves associated with isolating them (Reference drawings: 3A995009, 3A995050, 3A995138 and 3A995143).

Valve Numb	System Description /Piping, Valve Description
H9113M	Regeneration System
H9115M	Regeneration System
H771A	Outlet of Adsorber B
H371A	Outlet of Adsorber A
H426M	High Pressure to "Warm A "turbines
H826M	High Pressure to "Warm B "turbines
H15A	Inlet to Hx4
H82M	Process Isolation
H100A	Control valve high pot liquid level
H144M	Process bypass around liquid pots
H205A	Turbine 7 Outlet
H204A	Turbine 7 Inlet
H90A	High Pot Return
H89M	By-Pass
H88M	By-Pass
H87M	By-Pass
H38A	Process Return
H810M	Outlet of Turbine 6B
H410M	Outlet of Turbine 6A
H806A	Inlet Valve to Hx7B
H406A	Inlet Valve to Hx7A
H166M	High Pressure to Cold Turbines
H86A	High Pressure Supply
H159A	Inlet Valve to Hx7M

Helium Tube Trailers:

Trailers are occasionally used to pressurize piping for leak checking or ASME pressure checking. Inspect the area local to the cold box or turbine housing for any connections to trailers and verify with the cryogenic-control room (X3837) that there are no hazards associated with tube trailers.

Cold Surfaces:

The system has to be completely warmed to room temperature before the insulating vacuum is broken and before the access covers are removed.

Vacuum Systems:

Cold box 6 and Turbine pod 7 share a permanent piped vacuum pumping system with cold box 4, (Vacuum System 3). When the system is warmed to room temperature, the vacuum system is isolated from cold box 4 vacuum system and the vacuum space is to be broken with dry nitrogen gas. Contact the C-AD vacuum group for assistance.

Pneumatic Systems:

Valves located on the top and associated with the cold box and turbine pod are supplied with pressurized nitrogen or air at approximately 100 psig. Valves can be isolated via manifolds located local to the cold box and turbine pod.

Heights:

Work inside the cold box may involve climbing on process piping and working at elevated heights. Use harnessing and temporary scaffolding as necessary. Also care should be taken not to get tangled up in loose instrumentation wiring and small tubing.

ELECTRICAL SAFETY ISSUES

COLD BOX 6 INSTRUMENTATION CABLES

Careful inspection of the Cold box 6 indicates no lethal voltage potentials and no installed heaters internal to the valve box. There are no feed – through(s) externally that contain high voltages that would pass into the cold box. The only two feed - through(s) that exist are for low-level instrumentation (temperature sensors). See picture below.

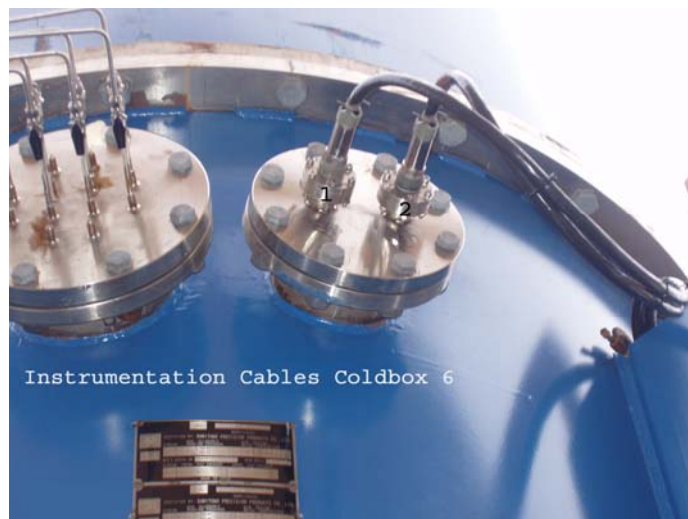


Photo 1

INSTRUMENTATION EXTERNAL OF TURBINE POD 7

The devices pictured below are located on the external structural frame that surrounds Turbine pod 7. The following table indicates the signal type associated with each device.

Device Designation	Signal Type
Throttle Valve H204A	4-20ma
Valve H204A closed limit switch	24Vdc
Brake Valve H75A	4-20ma
H206M Two Limit Switches	120Vac
Instrumentation Air Pressure Switch PSL075N	120Vac
Diff Pressure Switch DPS113H	120Vac
Flow Switches FSL-72W & FSL73W	24Vdc
Pressure Transducers PT65H, PT66H & PT68H	24Vdc/4-20 ma



Photo 2 - Valve H204A



Photo 3 - Valve H75A



Photo 4 - Pressure Switch PSL075N

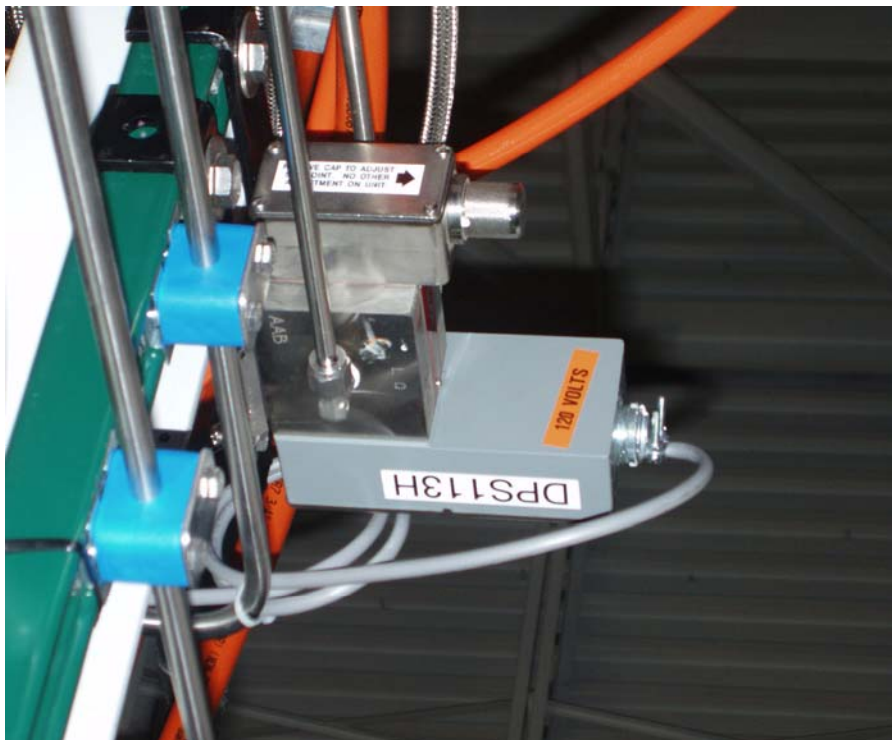


Photo 5 - Diff Pressure Switch DPS113H



Photo 6 - Flow Switches FSL-72W & FSL73W



Photo 7 - Pressure Transducers PT65H, PT66H & PT68H



Photo 8 - H206M Two Limit Switches

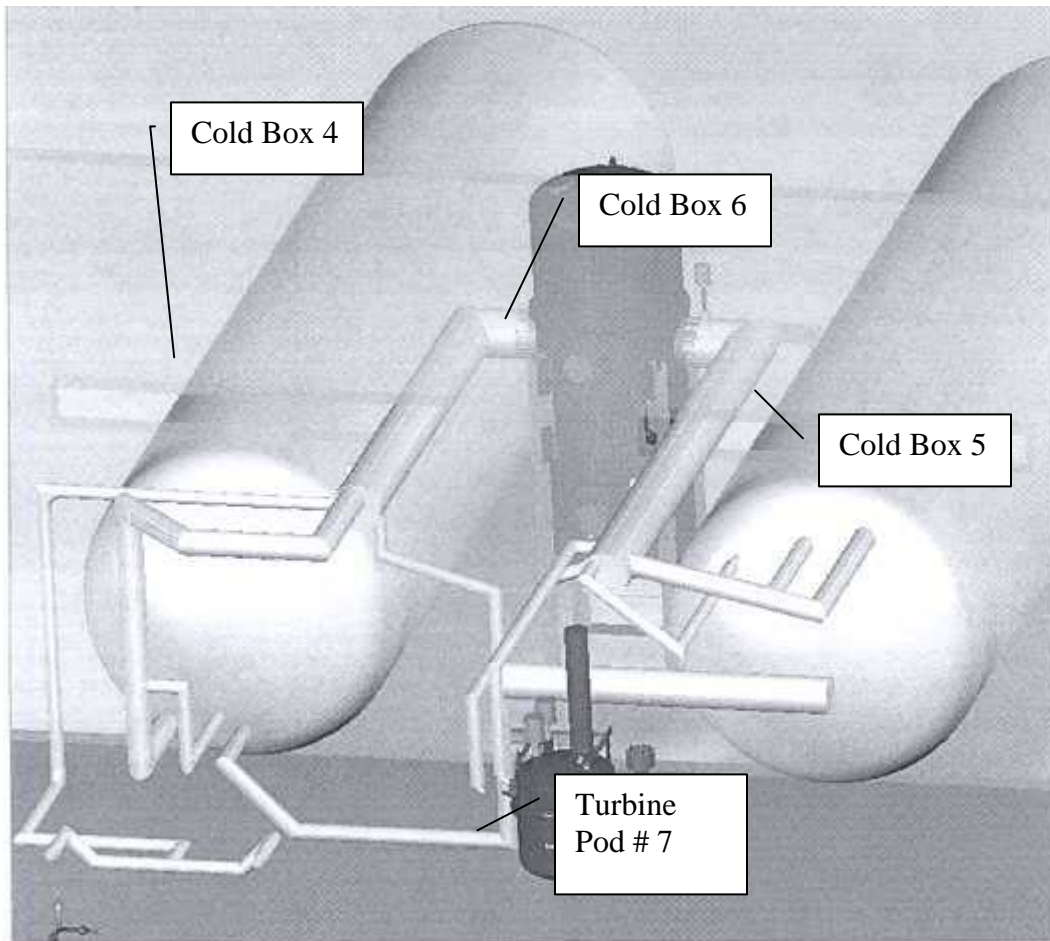


Figure A : Rendering of Cold Box 6 and Turbine Pod showing location of each.

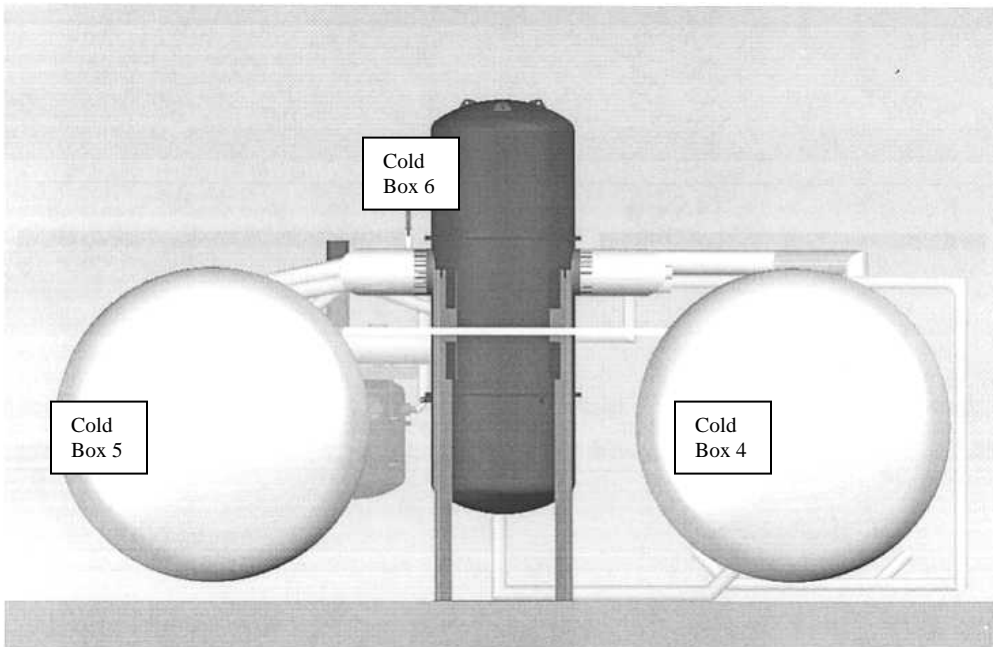


Figure B : Rendering of Cold Box 6. Out side 1005R looking South.

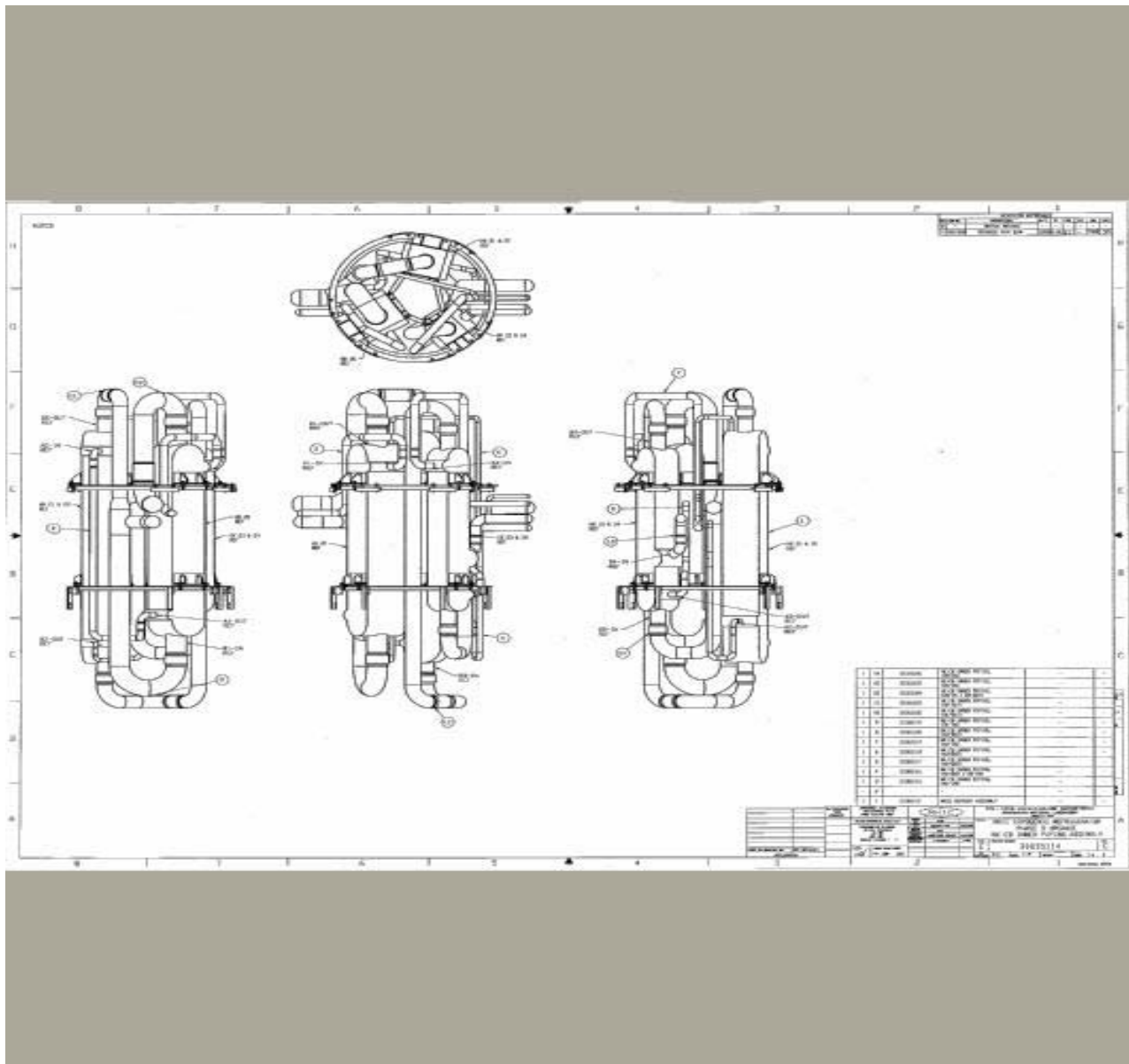


Figure C: - Cold Box 6 with the vacuum tank removed, drawing No.3105114-5-1.

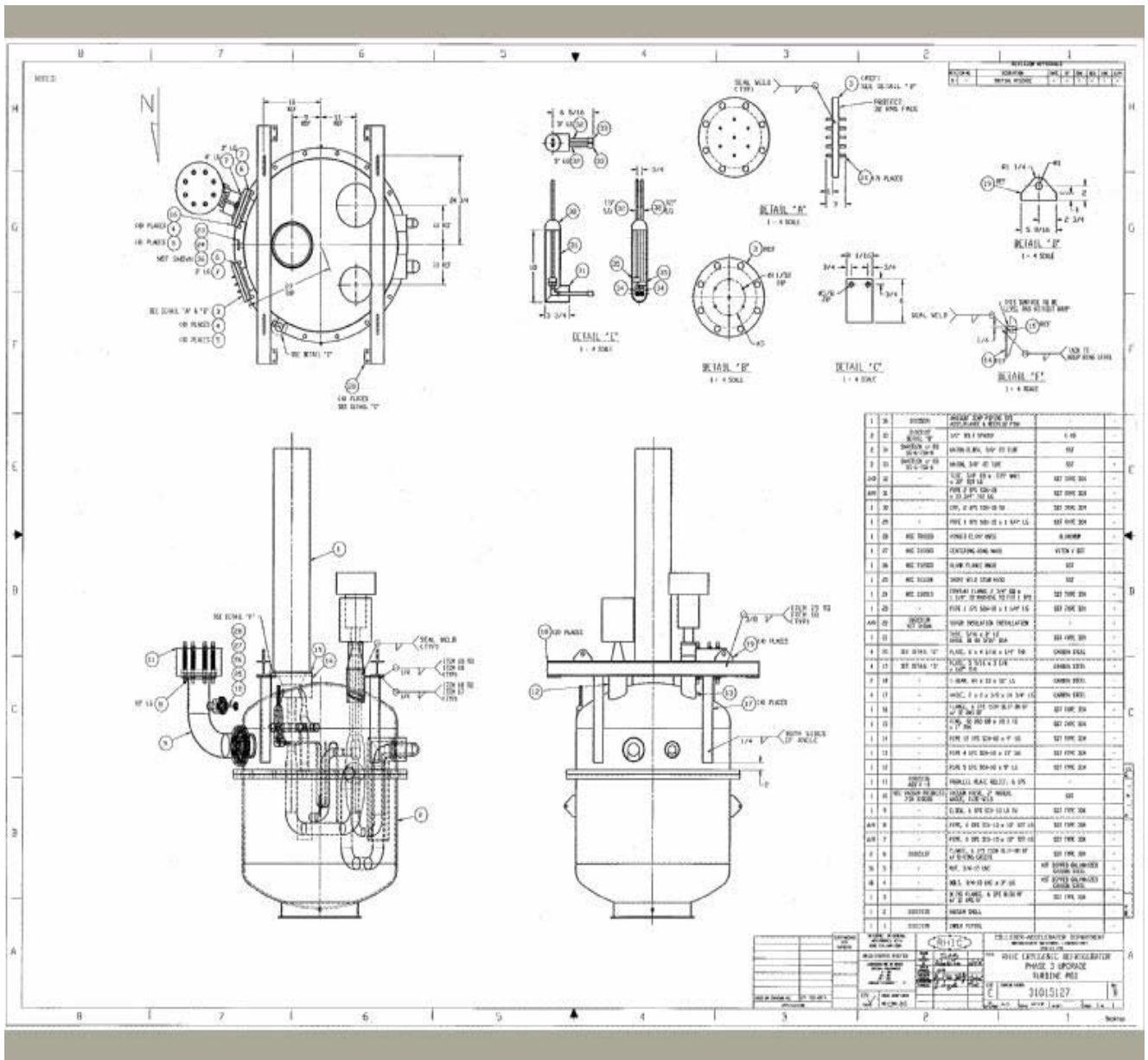


Figure D: Assembly drawing showing Turbine Pod 7, drawing No. 31015127.

Selected photographs



Photo 9 – View of turbine No. 7. The permanent ladder permits access to the top of the turbine pod.



Photo 10 – North side of the turbine housing, showing instrumentation lines.



Photo 11 – Cold Box No. 6 located between cold box 4 and cold box 5.



Photo 12 – View of cold box 6 from on top of cold box 5.



Photo 13 – Vacuum relief for the vacuum tank. Note: No man door on the cold box.



Photo 14 – View of the top half of the cold box, showing the vacuum jacket piping entering building 1005R.



Photo 15 – Another view showing the piping and the instrumentation tubing.



Photo 16 – Top shell of the cold box. To expose the inner piping and heat exchangers the sections must be unbolted and removed.

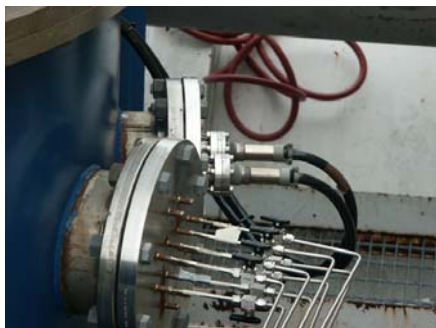


Photo 17 – Close up of the instrumentation tubing and cables for the electronic sensors.

Supporting Documents and drawings:

3A995047 Interconnecting Piping Diagram

3A995050 2-D Cold Box 4 P&ID

3A995009 RHIC 25Kw Helium Refrigerator P&ID

Spec. No. : Spec. No. CAD 1169 *Technical Specification for RHIC Refrigerator Upgrade Phase III Load Turbine System.*